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Signs and Symptoms of Detrusor Underactivity: An Analysis of Clinical Presentation and Urodynamic Tests From a Large Group of Patients Undergoing Pressure Flow Studies

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Abstract

Background: The clinical diagnosis of detrusor underactivity (DU) is hampered by the need for invasive pressure flow studies (PFS) in combination with a lack of knowledge of the associated signs and symptoms. This has contributed to a lack of awareness of DU and underactive bladder, and to the assumption that symptoms are always due to bladder outlet obstruction (BOO).
Objective: To investigate the signs and symptoms recorded in a large urodynamic database of patients who met the diagnoses of DU, BOO, and normal, to identify the clinical features associated with DU.
Design, setting, and participants: From the database of 28 282 adult PFS records, 1788 patients were classified into: (1) those with DU without BOO; (2) those with BOO without DU; and (3) those with normal PFS.
Results: Patients with DU reported a statistically significantly higher occurrence of decreased and/or interrupted urinary stream, hesitancy, feeling of incomplete bladder emptying, palpable bladder, and absent and/or decreased sensation compared with patients with normal PFS. Other differences were found between men with DU and BOO, and between women with DU and normal PFS.
Conclusions: There are signs and symptoms that can distinguish DU patients from patients with normal PFS and further distinguish between DU and BOO, which is traditionally invasively diagnosed. This is a first step to better understand the clinical presentation of DU patients, is consistent with the recent underactive bladder working definition, and justifies further exploration of the signs and symptoms of DU.
Patient summary: The clinical diagnosis of detrusor underactivity is hampered by the need for invasive urodynamics in combination with a lack of knowledge of the associated signs and symptoms. This study has shown that there are signs and symptoms that can distinguish men and women patients with DU from patients with either normal urodynamic studies or with BOO.

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1. Introduction

The clinical diagnosis of detrusor underactivity (DU) is hampered by the need for invasive pressure flow studies (PFS) and a lack of knowledge of the associated signs and symptoms. This has contributed to a lack of awareness of DU and its clinical correlate, underactive bladder (UAB) [1]. In consequence, this condition has been neglected compared with other causes of lower urinary tract symptoms. A recent review [2] concluded that DU "is

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surrounded by ambiguity" and recognises the limitations of the current definition. The International Continence Society defines DU as "a contraction of reduced strength and/or duration, resulting in prolonged bladder emptying and/or a failure to achieve complete bladder emptying within a normal time span" [3]. This, however, does not define "prolonged bladder emptying" or "normal time span". Various methods have been proposed to determine contraction strength [2]; however, none of these take into account the duration of contraction – a key factor in the definition [3].

Despite this imprecision, estimates suggest that DU is a prevalent condition, ranging from 9% to 23% in men <50 yr, increasing to as much as 48% in men >70 yr [2]. Elderly women show a DU prevalence ranging from 12% to 45% [2]. An analysis of the signs and symptoms associated with DU could potentially facilitate the diagnosis of patients with UAB, improve our knowledge of the epidemiology, indicate possible noninvasive diagnostic approaches, and facilitate the development and evaluation of treatment outcomes of new therapies for UAB [4].

The aim of this study was to investigate the signs and symptoms recorded in a large database of patients referred for urological evaluation who met strictly defined PFS criteria for DU, bladder outlet obstruction (BOO) or normal, in order to identify the clinical features associated with DU.

2. Materials and methods

Data from patients who underwent PFS, studied in a single specialist centre between 1985 and 2012, were recorded in a database that used the same variable fields throughout the 28-yr period.

Data gathering included patient interview to obtain symptoms and medical history, bladder diary data, physical examination, urodynamic studies, and diagnostic conclusions. PFS were carried out according to International Continence Society guidelines current at the time of testing. Free flow uroflowmetry was performed before each PFS. Postvoid residual urine volume was based on the volume obtained with catheterisation before filling commenced. The data from each PFS were screened for artefacts and manually entered into the database, thus avoiding automated data extraction errors. Prior to analysing the data, impossible values were removed in order to reduce corruption of data by manual entry errors. Several categorical (yes/no) variables used in the analysis were derived from a combination of database entry fields. For example, additional variables for straining and for decreased sensation were derived by combining the number of patients who reported these as symptoms with the number of patients for whom these were noted during PFS.

Patients without full voiding data, with neurological diseases affecting the lower urinary tract such as multiple sclerosis, paraplegia, or Parkinson's disease, and/or with a urodynamic diagnosis of detrusor overactivity were excluded as these require special consideration [5]. This resulted in 9928 eligible patient records (men: 1639; women: 8289) without confounding causes of vesico-urethral dysfunction (Fig. 1).

In order to classify patients with pure DU, BOO, or normal PFS, very strict criteria were used to avoid overlap. The criterion values were based on expert opinion and are shown in Table 1, which are in line with other studies cited by Osman et al [2]. A normal group was composed of patients with PFS judged to be normal, taking no medication related to bladder or urethra, and (for women) no clinical obstruction. Men who had both a low bladder contractility index and a high BOO index, suggesting simultaneous DU and BOO, were excluded from the analysis. Women patients with clinical obstruction, defined as urethral/bladder neck obstruction and/or large cystocoele or prolapse through the introitus, were also excluded from the DU and normal groups. Using these criteria, 1788 patient records (men: 507; women: 1281) were classified to DU, BOO, or normal PFS groups and used in the analysis (Fig. 1).

2.1. Statistical analysis

For all variables, the primary question was whether there was a difference in the reported values (numerical variables) or percentage of patients who reported a variable (categorical variables) for patients with DU compared with those with BOO or normal PFS.

For categorical variables, descriptive statistics for the number and percentage of patient records in each category were tabulated by patient group. Logistic regression models including patient group and age as factors were used for each binary variable. A p value for the hypothesis test that the odds ratio for each pair-wise comparison (DU vs BOO; DU vs normal PFS) was equal to 1 are provided with 95% confidence intervals. For example, a variable with an odds ratio for DU/BOO of 4.5 suggests that, after adjusting for age, the odds of a DU patient reporting the symptom are 4.5 times higher than for a patient with BOO. For cases where zero patients reported a variable outcome (ie, yes or no) in at least one group, estimates were obtained using exact logistic regression.

For numerical variables, descriptive statistics for the number of patients, median, and interquartile range (Q1–Q3) were summarised. PFS variables that were used to classify patients into groups (Table 1) were excluded from the analysis. Due to several variables appearing to be not normally distributed, a separate rank analysis of covariance model using patient group as factor and age as covariate was used for each pair-wise comparison (DU vs BOO; DU vs normal PFS). The rank analysis of

Table 1 – Inclusion criteria used for patient grouping

	Men			Women			
Group	BCI	BOOI	BVE %	$p_{detQmax}$	Q_{max}	BVE %	Excluding CO[b]
DU	<100	<20	<90	<20	<15	<90	X
BOO	≥100	≥40	≥90	≥40	<12	≥90	
Normal PFS[a]	≥100	<20	100	≥20	≥20	100	X

BCI = bladder contractility index; BVE = bladder voiding efficiency; BOO = bladder outlet obstruction; BOOI = Bladder Outlet Obstruction Index; CO = clinical obstruction; DU = detrusor underactivity; $p_{detQmax}$ = detrusor pressure at maximum flow rate; Q_{max} = maximum flow rate; PFS = pressure flow studies.

[a] A normal pressure flow study is a test with no abnormal pressure flow study findings and no present medication use related to bladder or urethra, in addition to the criteria listed.

[b] Clinical obstruction for women patients was considered as the clinician recording either a urethral or bladder neck obstruction during a video urodynamic test or a large cystocoele or prolapse through the introitus on examination.